

FIVE-YEAR REVIEW REPORT

SOLID STATE CIRCUITS

REPUBLIC, MISSOURI

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Jefferson City, Missouri

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TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	FIVE YEAR REVIEW PROCESS OVERVIEW	1
III.	SCOPE AND NATURE OF THE SOLID STATE CIRCUITS FIVE YEAR REVIEW	1
IV.	SITE HISTORY	2
V.	SITE GEOLOGY AND HYDROGEOLOGY	3
VI.	REMOVAL HISTORY	4
VII.	REMEDIAL HISTORY	7
VIII.	SUMMARY OF THE SELECTED REMEDIAL ALTERNATIVE IN THE RECORD OF DECISION (ROD)	10
IX.	STATEMENT OF PROTECTIVENESS	11
X.	NEXT REVIEW	12

APPENDIX

A.	SITE INSPECTION	13
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FIGURES

1.	LOCATION OF THE REPUBLIC, MISSOURI SITE
2.	SITE AND BUILDING DETAILS
3.	BEDROCK GEOLOGIC CROSS SECTION
4.	LOCATION OF MUNICIPAL WELLS, CAVE WELL AND ROBERTS SPRING
5.	LOCATIONS OF EXTRACTION AND MONITORING WELLS
6.	GROUNDWATER TCE CONCENTRATIONS, UNCONSOLIDATED FRACTURED SHALLOW BEDROCK SYSTEM (UFSB)
7.	GROUNDWATER TCE CONCENTRATIONS, UNFRACTURED SHALLOW BEDROCK SYSTEM (SBR)
8.	GROUNDWATER TCE CONCENTRATIONS, DEEP BEDROCK SYSTEM (DBR)
9.	RELATIONSHIP BETWEEN CAVE WELL, ROBERTS SPRING AND SHUYLER CREEK
10.	ALTERNATIVE II, PROCESS FLOW DIAGRAM

I. INTRODUCTION

This report documents the five-year review conducted by the Missouri Department of Natural Resources (DNR) at the Solid State Circuits, Republic, Missouri site, to determine if the remedial response actions at the site are still protective of human health, welfare, and the environment. Section 121 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and as implemented by section 300.430(f) (4) (ii) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) requires that periodic (at least once every five years) reviews be conducted for sites, where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use or unrestricted exposure, following the completion of all response actions for the site. The purpose of these reviews are to determine the continued adequacy of the response actions implemented in providing protection of human health, welfare and the environment.

II. FIVE YEAR REVIEW PROCESS OVERVIEW

The five-year review is to be conducted by the lead agency which is DNR, for the Solid State Circuits, Republic, Missouri site. In general, five-year reviews are to be started within five years of the initiation of the final response actions for the site.

The U.S. Environmental Protection Agency (EPA) has established three levels of review for the five-year reviews. Level I is the lowest level of evaluation of protectiveness, Level II is the intermediate level, and Level III is the highest level of evaluation of protectiveness. A Level I analysis will be appropriate in all but a relatively few cases where site-specific circumstances suggest another level. For example, the absence of the expected reduction in contaminant levels, as monitored, may suggest a Level II evaluation of the source control remedial component. Level III will never be proposed until the review is underway and site conditions dictate a more intensive review of the remedy.

III. SCOPE AND NATURE OF THE SOLID STATE CIRCUITS SITE FIVE YEAR REVIEW

This review of the Solid State Circuits site is a Level I review because it is unlikely that the response actions implemented at the site are no longer protective of human health, welfare, and the environment.

The five-year review included a site visit, conducted on May 15, 1996, to observe the current condition of the site response actions. The site visit report is included in Appendix A of this report.

In addition to the site visit, the following documents were reviewed in completing the five-year review:

- Record of Decision (ROD) including all attachments.
- Consent Decree /Statement of Work (CD/SOW).
- Remedial Action (RA) construction documents.
- Remedial Action (RA) Operation and Maintenance Plan.
- 100% Remedial Design (RD) Document Package.
- Trust Fund Financial Statements.
- Historical and current analytical data on the Site including the most recent hydraulic performance and chemical monitoring data.
- Other guidance and regulations to determine if any new applicable or relevant and appropriate requirements (ARARs) relating to the protectiveness of the response actions have been developed since implementation of the response actions.

IV. SITE HISTORY

The Solid State Circuits site is located on the southwest corner of the intersection of Main and Elm Streets in Republic, Missouri (Figure 1). It is a former industrial and manufacturing site which was leased and operated by a number of business concerns through the years. The site and former plant building apparently was constructed prior to 1902 and was originally operated by a milling company. Based on a review of historical photos, the building extended the entire length of the block from Mill Street to Elm Street. The building was one story except for the northern end, which was four stories high (Figure 2). Sometime between 1902 and 1937, a cold (refrigeration) plant began operations in the northern end of the building. Very little is known about the specific uses of the former plant building and land or what chemicals may have been used there from approximately 1930 to 1968.

Solid State Circuits began manufacturing operations in the northern end of the building in 1968 and continued until November, 1973. The Solid State Circuits site operated prior to the Resource Conservation and Recovery Act (RCRA) of 1980. Solid State Circuits manufactured printed circuit boards in the plant and used trichloroethylene (TCE) as a cleaning solvent in portions of its manufacturing process. Reliable volume estimates of TCE and other chemicals used at the site have not been available. Solid State Circuits

plant waste water reportedly contained copper, chromium, iron, ammonium, manganese, and zinc; however, the reliability of this information is not known. Wastes were reported to have been temporarily stored in a sump pit in the basement. A capped well was also found in the basement.

In November 1973, Solid State Circuits moved its manufacturing operations to Springfield, Missouri. The Solid State Circuits site was occupied thereafter by Micrographics, Inc., a photographic processing firm, and possibly other businesses until 1979. Micrographics, Inc. occupied the northern end of the building. Other businesses which may have operated on the premises and the chemicals they may have used have not been determined. In November 1979, the northern end of the building was destroyed by fire. Some witnesses have stated that the basement had a strange odor and everything appeared green and corroded prior to the fire. During the fire, other witnesses stated they saw several fifty-five gallon drums in the basement; however, investigative excavations did not confirm this. After the fire, the damaged portion of the structure was demolished and the debris was pushed into the basement under that portion of the building. This area became a vacant graveled lot which was used for occasional parking.

The remaining southern portion of the building and the vacant graveled lot were owned by the Crane Manufacturing Company of Crane, Missouri. Mr. Nicholas Weinsaft purchased the former Solid State Circuits property in 1976. The only known tenant of the southern portion of the building was a factory outlet store. This portion too has become vacant and has deteriorated over the years.

V. SITE GEOLOGY AND HYDROGEOLOGY

The Solid State Circuits facility is located in Republic, Missouri. Republic lies on a broad upland setting with regional karst development. This setting is within the Springfield-Salem Plateau section of the Ozark Plateau physiographic province, the Interior Highlands Division. Rocks of Mississippian Age underlie most of the region (Figure 3). Mississippian Formations are generally coarse crystalline limestone which contains discontinuous beds of chert. There exists a sequence of three hydrologic groundwater systems or aquifers underlying the site: (1) the unconsolidated/fractured shallow bedrock system, (2) the shallow bedrock aquifer, and (3) the deep bedrock aquifer. The deep bedrock aquifer is isolated from the shallow aquifers by a confining layer.

The Unconsolidated/Fractured Shallow Bedrock Zone (UFSB) includes the residual unconsolidated soil materials above bedrock and the upper fractured zone of the shallow limestone bedrock down to approximately 75 feet below land surface (bls). The 10 to 20 feet thick overburden consists of stony red clay residuum derived from weathering of the bedrock. It has moderate to high permeability and water is thought to be perched at the

soil-bedrock contact. The bedrock is a cherty limestone that has solution weathering along joints and bedding planes, which are avenues of rapid fluid transport to groundwater. Small spring and cave systems exist in and around Republic. These features are a result of the solution of the Mississippian Aged Burlington-Keokuk Limestone bedrock. Regional groundwater flow in the UFSB is generally to the south-southeast towards the Shuyler Creek drainage system. Locally, in the vicinity of the site, groundwater flow is towards the "Main Street Fracture System" which acts as a groundwater sink.

The Shallow Unfractured Bedrock Zone (SBR) includes the lower unfractured shallow limestone bedrock from approximately 75 feet bls down to the Northview Shale at about 300 feet bls. Regional groundwater flow in the SBR is generally to the southeast with possible local influence from the Republic Municipal Supply Well pumpage.

The Deep Bedrock Zone (DBR) includes the deep limestone/dolomite/sandstone bedrock below the Northview Shale at depths greater than approximately 300 feet bls. Under static, non-pumpage conditions, the regional direction of the groundwater flow is to the southeast. However, due to the strong influence from the municipal supply groundwater withdrawal in Springfield, Missouri, groundwater flow in the Republic area is generally to the northeast towards Springfield. Locally, groundwater flow is influenced by and is toward the Republic municipal supply wells.

VI. REMOVAL HISTORY

In June 1982, DNR collected samples from the city of Republic's three municipal wells for analysis of volatile organic compounds (VOCs) as part of EPA's National Synthetic Organic Chemistry Survey. A trichloroethylene (TCE) level of 15 micrograms per liter (ug/l) was detected in Republic's Municipal Well No. 1, which was located 500 feet south of the former Solid State Circuits manufacturing site. Additional sampling by DNR confirmed the presence of TCE in this well, and it was taken out of service sometime between July 1983 and March 1984. Samples indicated that Municipal Wells Nos. 2 and 3 were not contaminated with VOCs.

DNR has collected and analyzed samples from the uncontaminated municipal wells on a monthly basis throughout the Removal and Remedial History of the Site. Except for Municipal Well No. 1, all of the municipal wells and the Republic distribution system associated with the wells (Figure 4) have been found clean and have remained so to the present.

In April 1983, DNR and EPA initiated response actions to identify possible contaminant sources and to further investigate the TCE occurrence in Municipal Well No. 1. The former Solid State Circuits manufacturing plant was identified as one of the potential sources of the TCE.

On August 26, 1983, DNR notified the property owner, Mr. Nicholas Weinsaft, that the Solid State Circuits site was proposed for inclusion on the Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri. On September 15, 1983, Mr. Weinsaft appealed the listing on the basis that he wished to either delete the property from the Registry or decrease the size to be included on the Registry. DNR and Mr. Weinsaft reached an agreement on October 22, 1984, concerning the property to be placed on the Registry. The Registry would not include property still in use by Mr. Weinsaft. The property to be included was located immediately adjacent to and against the north wall of the building owned by Mr. Weinsaft.

The Solid State Circuits site was placed on the Registry as a Class I site on February 22, 1985. It was classified as a Class I site, because it presented an imminent danger of causing irreversible or irreparable damage to public health and the environment. Immediate cleanup action was required at this site. Cleanup activities included the removal of over 2,000 cubic yards of contaminated material, plugging the basement's well, removal from service of Republic's Municipal Well No. 1, installation of Municipal Wells Nos. 4 and 5, creation of an on-site treatment system of extracted groundwater using air strippers, continuous pumping to the sewer of Municipal Well No. 1, and installation of monitoring wells to monitor the contaminated groundwater. With the completion of cleanup activities and the initiation of long-term groundwater monitoring, the site's classification was reduced in 1995 to a Class IV site. Class IV status indicated that the site has been properly closed but requires continued management.

From March to November 1984, DNR conducted response activities at the Solid State Circuits site. The activities were divided into four separate phases. Solid State Circuits was involved with Phases II and IV of the DNR investigation from March 29 to May 25, 1984.

During Phase I, DNR sampled Roberts Spring, a local well designated as Cave Well, and Municipal Wells Nos. 1, 2 and 3. Municipal Well No. 1 was pumped for 10 days prior to sampling. TCE concentrations in Municipal Well No. 1 decreased from 140 ug/l to 25 ug/l in five days. TCE was detected only in the Municipal Well No. 1 samples.

During Phase II, Solid State Circuits financed the excavation of approximately 1,500 cubic yards of soil and debris from the former building basement area, and extensive soil and water sampling in and around the basement area. Only three containers were discovered in the basement area. They were a crushed fifty-five gallon drum, an empty crushed five gallon can, and a cracked thirty gallon cylinder. Additional features discovered in the basement area were an old basement well about 540 feet deep, an elevator shaft, a sump of unknown function, and a sewer box. TCE was found in samples of the fill dirt and rubble excavated from the basement, in water from the basement, in the shallow groundwater outside the basement area, and in groundwater samples taken at various depths in the 540-foot well. Approximately 75 to 150 cubic yards of excavated soil and debris were transported from the site and disposed at Bob's Home Service in

Wright City, Missouri. The remaining soil, somewhere between 1,325 and 1,425 cubic yards, was temporarily stored on the site.

During Phase III, DNR pumped Municipal Well No. 1 for 24 hours to monitor its effect on the basement well and an off-site monitoring well, but the results were inconclusive. Two groundwater samples were collected from Municipal Well No. 1.

During Phase IV, Solid State Circuits financed additional excavation and sampling beneath the basement floor and installed three shallow unconsolidated monitoring wells. Several sub-basement pipes were encountered. The basement well had two holes in the casing and appeared to receive recharge water from the surface drainage system. Samples showed continued high levels of TCE in the Solid State Circuits basement well, the shallow groundwater, and the soil beneath the site. From October to November 1984, DNR cleaned out the basement well, recased it, and installed a submersible pump. Due to poor recharge flow, the well was determined to be a poor candidate for use in recovering contaminated groundwater.

On April 5, 1985, the EPA Regional Administrator signed an Action Memorandum (AM) which allowed EPA to undertake an immediate removal at the site. These activities were undertaken to prevent the potential threat to public health and the environment posed by approximately 1,400 cubic yards of contaminated soil that remained on the site. Removal action began on April 18, 1985. Samples were taken to define additional areas requiring excavation. Additional excavation of the basement area occurred from late-April to mid-May 1985. Excavation was terminated when bedrock was encountered. Approximately 800 cubic yards of contaminated soil was removed from beneath the basement floor. Four new shallow off-site monitoring wells (Figure 5) were installed from May 6 to 8, 1985.

Approximately 1,990 tons of contaminated soil and debris was transported to the Adams Center Landfill near Fort Wayne, Indiana between September 4 and October 3, 1985. On October 7, 1985, DNR announced that they would be assuming long-term responsibility for the remedial cleanup of the Solid State Circuits site. Two recovery/monitoring wells were also installed on-site at this time. REM-2 was completed to a depth of 331 feet on the west side of the site within the perimeter of the former basement area to monitor the shallow bedrock aquifer. REM-1 was completed at a depth of 600 feet on the east side of the site outside the perimeter of the former basement area to monitor the deep bedrock aquifer. Pumps were installed in both wells on October 30, 1985. The old basement well was sealed. The excavated basement area was filled with 85 tons of gravel forming a one foot layer. A sufficient quantity of clean fill dirt was then placed over the gravel to bring the excavated area up to grade. The wooden fence around the site was replaced with a

chain-link fence to improve site security. Final grading and seeding of the area took place on October 31, 1985.

VII. REMEDIAL HISTORY:

On December 18, 1985, Solid State Circuits submitted a plan to DNR to conduct the Remedial Investigation/Feasibility Study (RI/FS) at the site. The RI/FS Work Plan was submitted in December 1985. EPA placed the Solid State Circuits site on the National Priorities List (NPL) on June 10, 1986. DNR and EPA approved the Work Plan in December 1986. Additional documents were prepared and final approval allowed for Solid State Circuits began field work for the Remedial Investigation/Feasibility Study (RI/FS) in June 1987.

Between June and December 1987, a No. of tasks were performed. The Sewer System Survey was conducted and the sewer system associated with the site was found to be contaminated. The Private Well Survey found that no households near the site were using their private wells because everyone was hooked up to the City Water System. Eight new monitoring wells and their protective casings for the new continuous water level recording equipment were drilled, tested and sampled. Quarterly sampling of these wells began. Disposal guidelines for the Publicly Owned Treatment Works (POTW) and the Treatment Plant were set by the State Water Pollution Control Program. The two air stripper towers were constructed and tests done during the Pilot Study indicated that they were operating as designed. The site was cleaned up, graded and seeded.

The RI/FS field activities continued at the Solid State Circuits site in 1988. Municipal Well No. 4 was constructed in November and brought on-line. Monthly sampling of the Municipal Wells continued. Municipal Well No. 1 continued to be pumped. A geophysical survey of the shallow bedrock system was completed. Additional monitoring wells were constructed, tested and sampled. Quarterly sampling, monitoring, and water level measurements of the shallow and deep wells continued. The air stripper building was constructed. Installation and modifications of the automatic control system for the on-site well pumps and air stripper towers was completed and brought on-line.

With the installation of the double walled pump discharge pipe for the deep wells, the field construction activities for the RI/FS were complete. Monthly sampling of the Municipal Wells continued. Municipal Well No. 1 continued to be pumped. Quarterly sampling, monitoring, and water level measurements of the shallow and deep wells continued. These activities will continue unchanged until later noted.

The RI was written and approved in June 1989. It identified plumes of TCE contamination suspended in and moving with groundwater in each of three aquifers underlying the site (Figures 6, 7, and 8). The FS was written and approved in July 1989.

It evaluated the four remedial alternatives in detail. The Administrative Record (AR) which included the RI/FS and the Proposed Plan were released to the public on August 14, 1989. A public comment period and public meeting were held. After considering the public comments, the EPA, with State concurrence, selected the RA to be implemented at the Site. The ROD was approved and signed September 27, 1989.

On December 13, 1989, the EPA invited Solid State Circuits to participate in negotiations for a settlement to conduct or finance the Remedial Design/Remedial Action (RD/RA) in accordance with the ROD. From December 1989 through July 1990, Solid State Circuits, EPA and DNR negotiated the terms of a CD/SOW for the RD/RA. Near the end of negotiations, DNR and EPA learned that Solid State Circuits was contemplating a sale of its assets and the establishment of a trust fund to finance the remediation. This contingency was worked out and included in the CD. Solid State Circuits signed the CD/SOW on July 2, 1990.

DNR and Solid State Circuits conducted a hydrogeologic survey, in January and February 1990, using dye tracing to determine the existence of a hydrogeologic link between the UFSB plume and the shallow bedrock wells, and Cave Twin, Shuyler and Terrell Creeks, and Roberts Spring. The nine sampling rounds confirmed that a positive link exists between the shallow bedrock wells and Roberts Spring (Figures 5 and 9), and Cave Well and Roberts Spring (Figure 9).

Solid State Circuits sold their assets and the money from the sale was placed into the Solid State Circuits Trust Fund, managed by MRAC (Missouri Remedial Action Corporation), Inc. A Trust Agreement was submitted by MRAC in February 1991, and was approved in October 1991. MRAC's management of the trust fund to date has been satisfactory. Upon review, the funds in the trust fund have been projected to cover all future costs.

The CD/SOW for cleanup of the site was entered with the court on May 31, 1991. Before the Pilot Remediation Program began, it was determined that the stack heights of the two air strippers needed to be increased. While replacing the stacks, the mechanical components of the volatilization process were also changed. The Pilot Remediation Program began in September 1991. The program consisted of on-site treatment of the extracted groundwater using air strippers. The Pilot Program was completed in January 1992. Effectiveness during the Pilot Program was 98% to 99% removal of TCE.

The 75% RD package was submitted on May 4, 1992, and it included the results for the Pilot Remediation Program. Comments were sent MRAC on June 30, 1992. MRAC was requested to submit, prior to the 100% RD package submittal, for review and comment the designs and specifications for the industrial computer system and sewer level sensors, the design specifications for the proposed Data Management System, and the results of the Air Modeling. On October 5, 1992, DNR and EPA received the 100% RD package.

On December 22, 1992, DNR approved, with EPA's concurrence, the 100% RD package for the cleanup of the groundwater.

Implementation of the RA construction began on January 11, 1993. Construction activities dealt with the installation, testing and sampling of on-site and off-site extraction wells and their connecting pipelines to either the nearest sewer manholes and/or the on-site pump and treat system. Construction completion connected all three hydrogeologic zones to the site, thus allowing for their remediation via the pump and treat system. The treated water is then discharged off-site to Republic's POTW (Figure 10). RA construction activities were completed on September 20, 1993. On October 29, 1993, DNR sent EPA the final "Preliminary Close Out Report" for the Long-Term RA at the Solid State Circuits, Republic, Missouri site. EPA sent DNR the signed copy of the document on December 1, 1993.

Also during this time, Municipal Well No. 5 was constructed, tested, and sampling began. During routine pump maintenance, an odor problem was noted in Municipal Well No. 2. It was taken off-line and remained off-line the remainder of the year. Tests revealed that it was not contaminated with TCE or VOCs. Starting in July 1993, chemical monitoring and hydraulic performance reporting for the monitoring wells changed from monthly to quarterly.

Quarterly chemical monitoring and quarterly hydraulic performance reporting for the monitoring wells continued in 1994. Water sampling for the municipal wells and the distribution system changed from monthly to quarterly in January 1994. On March 29, 1994, DNR conducted a pre-certification inspection of the remedy at the Solid State Circuits site as per the CD/SOW. DNR's inspection determined that the RA construction activities were complete and that the remedy was operational and functional. EPA concurred with DNR on May 19, 1994. On May 31, 1994, DNR received the RA Certification Report and As-Built Drawings for the Solid State Circuits site from MRAC. On June 16, 1994, DNR notified MRAC that DNR and EPA jointly determined that the remedy for the Solid State Circuits site to be operational and functional. After receiving EPA's concurrence, DNR sent MRAC DNR's Certification of Completion of the RA for the Solid State Circuits site on September 16, 1994.

In 1995, water sampling was reduced to biannually for the Republic Municipal Wells and distribution system. It will continue at this rate for the next five years. Chemical monitoring reporting was reduced to semi-annual, while the hydraulic performance reporting for the monitoring wells remained quarterly. The DBR system developed problems maintaining its hydraulic performance criteria, of an average rolling rate of 75 gpm. This was due to a lower production rate from REM-1. Also, no contamination has been detected in CW-1 for two years. It has been proposed by MRAC that this part of the system be closed. To remedy this situation, aquifer testing was done at REM-1 to establish a new hydraulic performance criteria for the DBR system. Once established and agreed upon by the agencies and MRAC, a modification to the CD/SOW will be

made. The remaining portion of the system continued to operate and function as designed.

Over the years, the remaining portion of the old Solid State Circuits building continued to deteriorate. In July 1995, DNR was notified that the structural integrity of the old building adjacent to the Solid State Circuits Treatment System had deteriorated to the point of collapse and that it had become a safety hazard. Due to the critical nature of the situation, Mr. Weinsaft was notified and given written approval by DNR that the old building on Main Street should be demolished. There was good coordination between DNR, MRAC, and the city of Republic during the demolition. Representatives from the city of Republic and MRAC were present. This area is now graveled.

In 1996, water sampling continued to be conducted biannually for the Republic Municipal Wells and distribution system. Chemical monitoring reporting remains semi-annual and hydraulic performance reporting remains quarterly for the monitoring wells. Solid State Circuits has submitted the Five-Year Annual Report, which has been reviewed. The new hydraulic performance criteria has also been submitted and review is proceeding. A five-year review site inspection was conducted by DNR and EPA jointly with MRAC on May 15, 1996. This can be found in Appendix A.

VIII. SUMMARY OF THE SELECTED REMEDIAL ALTERNATIVE IN THE RECORD OF DECISION

Four remedial alternatives were developed to respond to the groundwater contamination in each of the three groundwater systems. The four remedial alternatives were evaluated using the nine criteria presented in OSWER Directive 9355.3-02, "Interim Final Guidance on Preparing Superfund Decision Documents: The Proposed Plan, the Record of Decision Amendment, June 1989". The remedial alternative chosen by EPA and approved by DNR that best met the requirements of the nine criteria, in accordance with CERCLA, as amended by SARA, and to the extent practical, the NCP, was Remedial Alternative II. It was deemed most protective of human health and the environment, and complied with all Applicable or Relevant and Appropriate Requirements (ARARs). Remedial Alternative II includes the following components:

- Extraction of contaminated groundwater from the three hydrologic systems - the UFSB system, the SBR system, and the DBR system - that contains VOCs, principally TCE by using existing and new wells;
- On-site treatment of extracted contaminated groundwater using the two existing air strippers;
- Discharge of treated water to the city of Republic sewer system to receive further treatment at the POTW;

- A municipal ordinance to prevent construction of drinking water wells in or near the contaminated groundwater plumes; and
- Continued groundwater monitoring and reporting to determine the effectiveness of the remedy.

IX. STATEMENT OF PROTECTIVENESS

Once TCE contamination was discovered in the city of Republic's Municipal Well No. 1 and the source was traced to Solid State Circuits, removal and remedial objectives were established for the Solid State Circuits Republic, Missouri site. Removal of the contaminant source, prevention of continued contamination of the deep aquifer, and prevention of the expansion of the plume towards Municipal Well No. 2 were the site's removal objectives. Prevention of the potential of human exposure to the contaminated groundwater, protection of the uncontaminated groundwater, and restoration of the contaminated groundwater were the site's remedial objectives.

Removal actions taken by DNR and EPA consisted of excavating and disposing of over 2,000 cubic yards of contaminated material from the site, plugging the well found in the basement, and removing Municipal Well No. 1 from service. Excavation and removal removed the source of contamination from the site. Plugging the basement well has closed the conduit from the source of contamination to the deep aquifer. Taking Municipal Well No. 1 out of service, removes the conduit from the deep aquifer and the City's Municipal Water supply to individual homes and businesses. Using Municipal Well No. 1 for the removal of contaminated groundwater from the deep aquifer began at this time. This began the removal of contaminants from the groundwater, thus preventing the further migration of the contaminant from the site.

Remedial actions taken by DNR and MRAC consisted of constructing new monitoring wells, constructing the two air strippers, and constructing two new municipal drinking water wells. The existing and new monitoring wells have been used in a pump and treat system. The contaminated groundwater is pumped from the three hydrologic systems to the air strippers for treatment. Volatilization of the contaminants from the groundwater occurs within the air strippers. The water is then sent to Republic's POTW for further treatment. The pump and treat system is preventing human exposure to the contaminated groundwater by removing it from the three hydrologic systems. This removal is protecting the uncontaminated groundwater for future use by preventing the migration of the contaminant plumes. Also, it is restoring the contaminated groundwater for future use by reducing the TCE concentrations to acceptable state and federal standards. The construction of the two new municipal water wells has provided for a clean, adequate water supply for the city of Republic. Thus, the potential for human exposure to contaminated groundwater is being prevented.

Upon reviewing the documentation on this site and completing a site visit, it has been determined that the response actions to date are fulfilling the cleanup objectives for this site. To date, no one is presently being exposed to contaminated groundwater from the three hydrologic systems, no contamination has been detected in Municipal Wells Nos. 2, 3, 4, or 5, and the pump and treat system and pumping of Municipal Well No. 1 has removed TCE contamination from the hydrologic systems for treatment and disposal, thus reducing the amount of TCE in the groundwater.

Thus the response actions taken by MRAC with oversight by DNR and EPA, together with the long-term maintenance and monitoring provided by Solid State Circuits (MRAC, Inc.) continues to protect the public health, welfare, and the environment from the remaining TCE contamination at the Solid State Circuits, Republic, Missouri site. No new or significant information was discovered during this review to indicate that the remedy does not continue to be protective.

X. NEXT REVIEW

DNR and EPA believe that five-year reviews will continue to be necessary at this site, since hazardous substances, pollutants, or contaminants remain at the Solid State Circuits site above levels that would allow for unlimited use or unrestricted exposure. Accordingly, DNR plans to perform another five-year review as required by statute.

A. SITE INSPECTION

I conducted a site visit of the Solid State Circuits site in Republic, Missouri, on May 15, 1996. The purpose of the visit was to acquaint myself with the site and inspect it for the Annual and Five-Year Reviews and to meet the other people associated with the site. I was accompanied by Ms. Julie Warren of the Hazardous Waste Program, Mr. Steve Auchterlonie of the U.S. Environmental Protection Agency, Mr. Greg Vierkant of MRAC, Inc., and Mr. Steve Chatman, Mr. Matt Kramer, and Ms. Laura Coffman of Chatman and Associates, Inc.

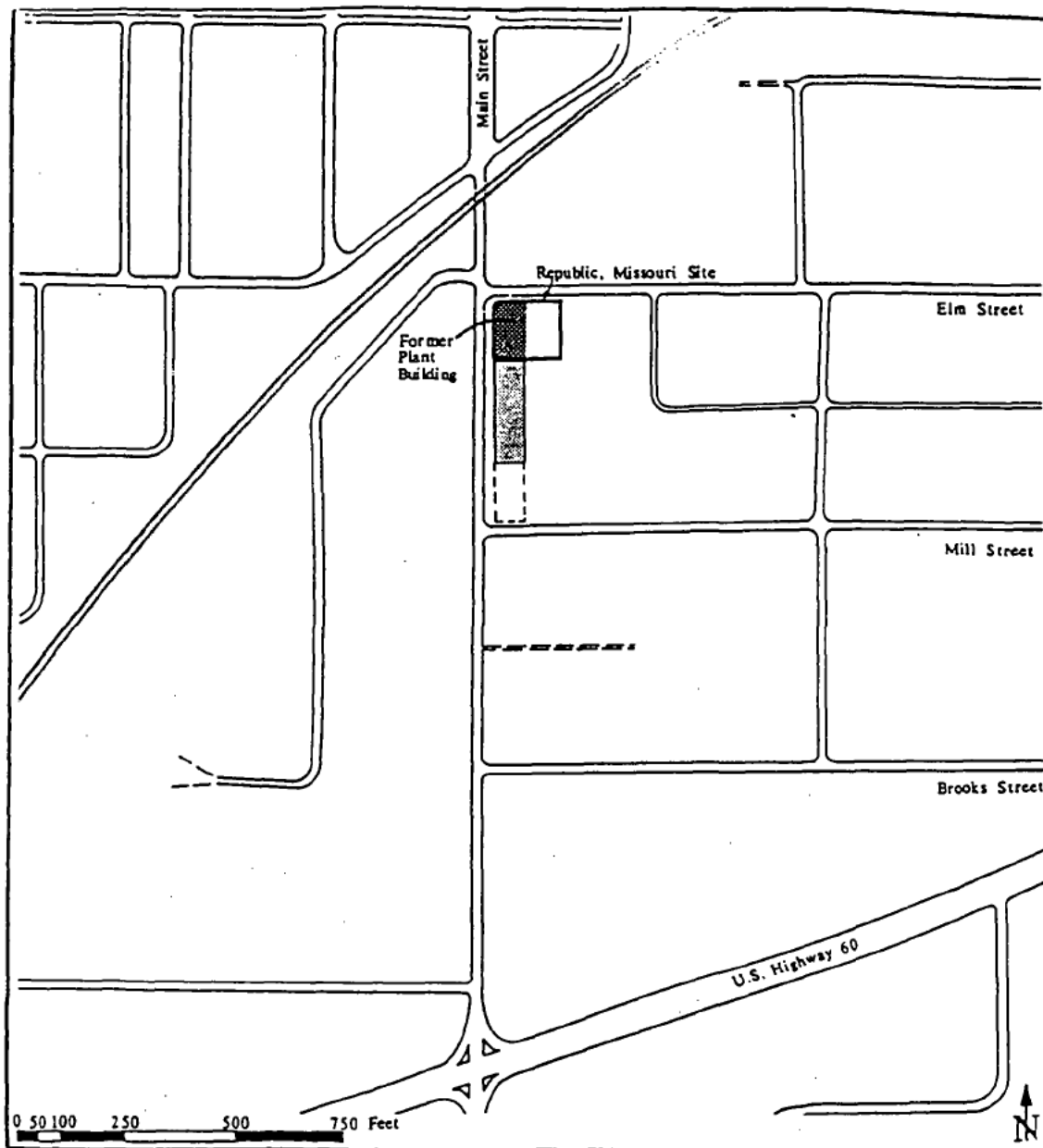
We walked the fenced perimeter of the site. Well maintained signs were posted on the gate and on the chain-linked fence of the site. The maintenance and air stripper buildings, the air stripper towers, the outer casing, pads, and well heads of the monitoring and extraction wells appeared to be in good operating condition and properly secured. The parking area was graveled. Landscaping was tastefully done.

Inside the air stripper building, the air strippers themselves, and associated pumps, valve, piping, gauges, electrical, mechanical, and water hookups and the computer appeared to be in good operating condition. Mr. Vierkant demonstrated the functions of the computer and how the program functioned in its automatic monitoring and record keeping of groundwater elevations, performance criteria, precipitation, and pumpage data.

It was noted that the old building just off-site is still vacant and has deteriorated. Vandals have also begun to add to the overall deterioration of the building. It was recommended that the building may need to be torn down sometime in the future.

The remaining monitoring and extraction wells were visited and inspected. It was noted that they appear to be well maintained and secured. Where necessary, additional bumper posts and/or concrete pads have been erected to ensure the security of the wells.

A visit to Cave Well and Shuyler Creek were also conducted to obtain a perspective on the relationship and importance of these features to the site.



LOCATION OF THE REPUBLIC, MISSOURI SITE

- Former Plant Building
 - Existing One-Story Building
 - Former Extent of One-Story Building
- Prepared for: Solid State Circuits, Inc.

203B:23MAY89S

Project Manager: Steven D. Chatman

Geraghty & Müller, Inc.

Figure 1
Location of Solid State Circuits in Republic, Missouri

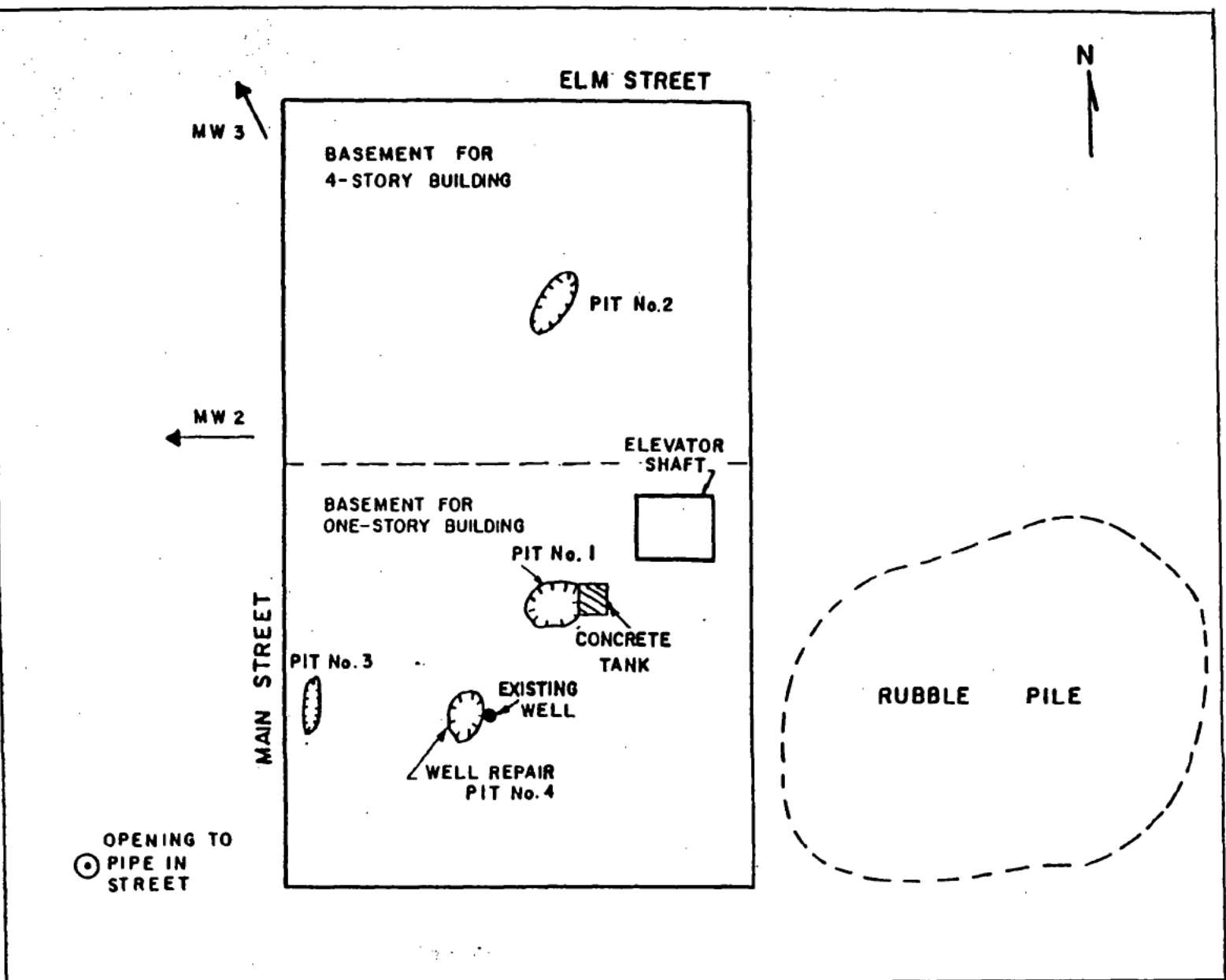
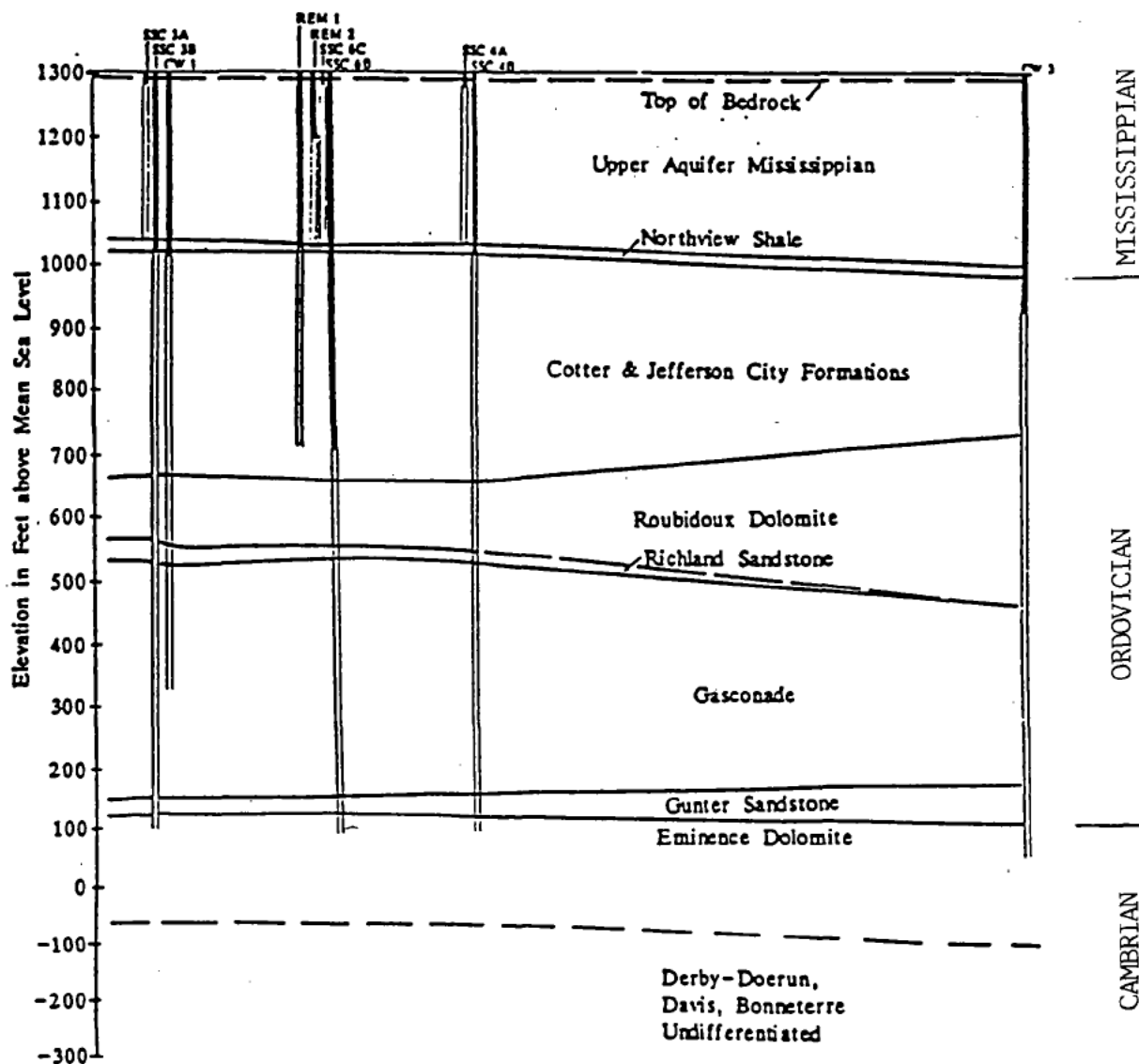


Figure 2
Site and Building Details



BEDROCK GEOLOGIC CROSS SECTION

| Casings
 || Open Borehole

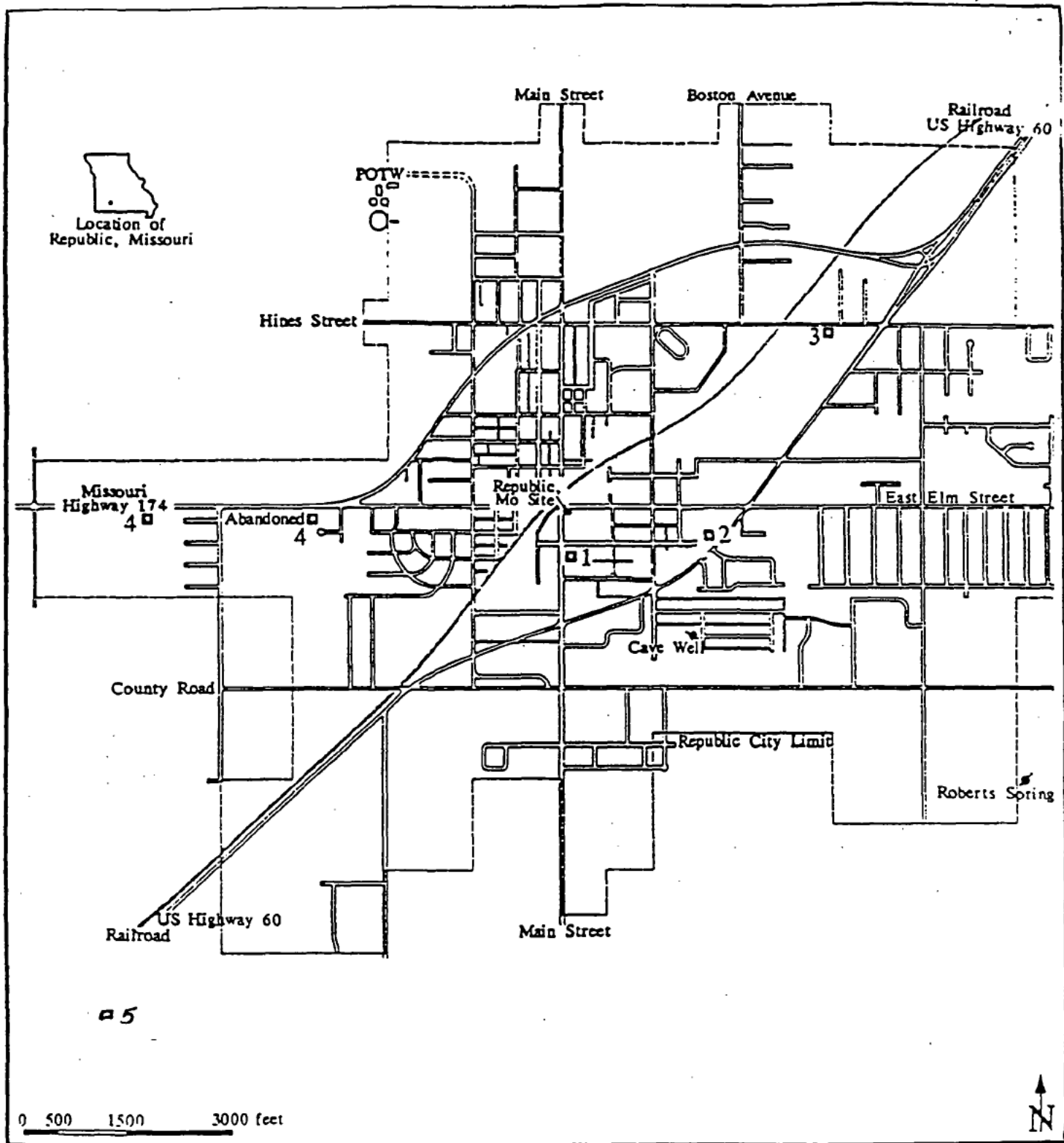
Prepared for: Solid State Circuits, Inc.

203E

Project Manager: Steven D. Chatman

Geraghty & Miller, Inc.

Figure 3 - Bedrock Geologic Cross Section



MAP OF REPUBLIC, MISSOURI

- CW- Municipal Well
- Cave Well
- ▲ Roberts Spring

Prepared for: Solid State Circuits, Inc.

203B/23MAY89S

Project Manager: Steven D. Chatman

Geraghty & Miller, Inc.

Figure 4
Location of Municipal Wells, Cave Well, and Roberts Spring

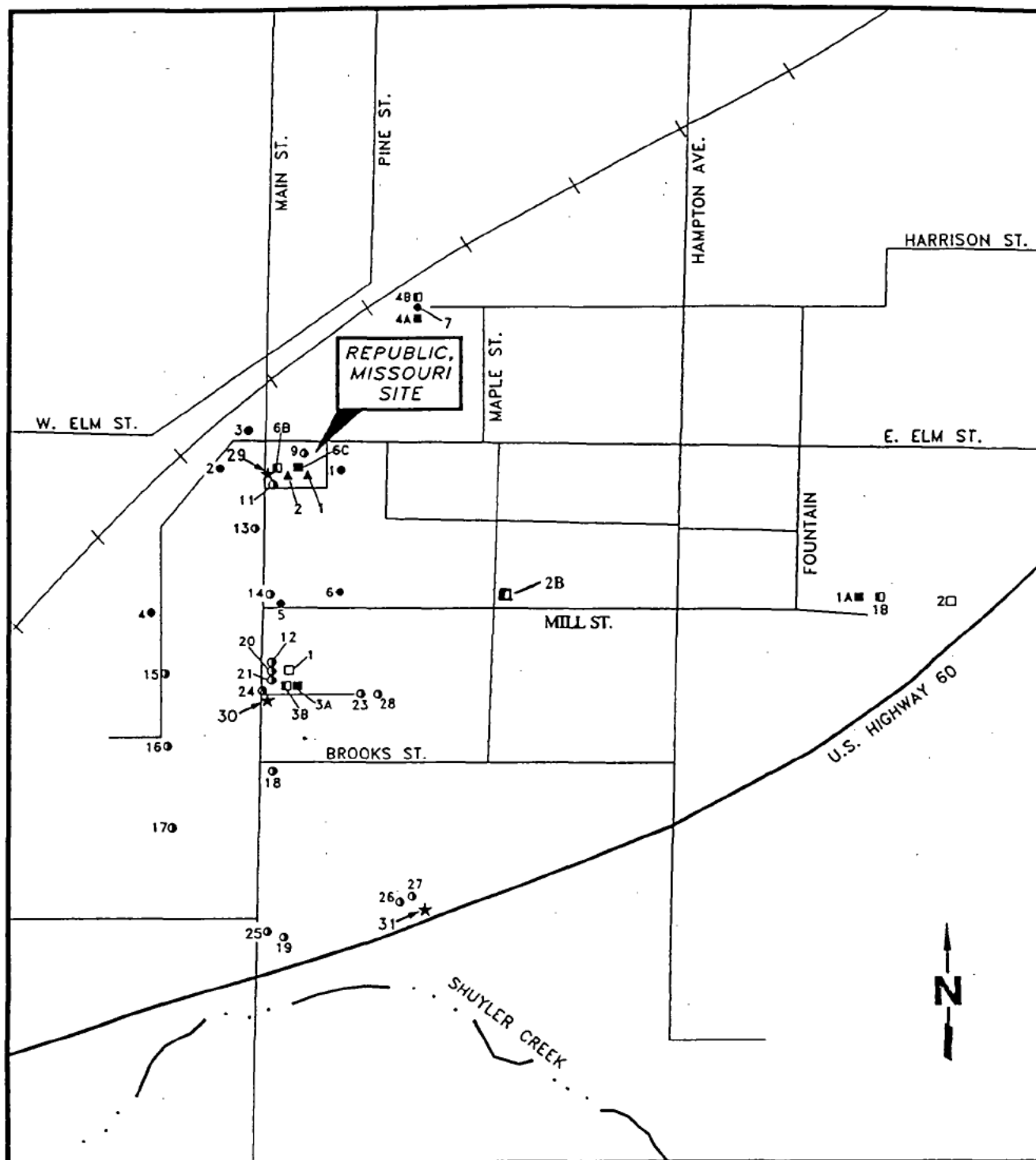


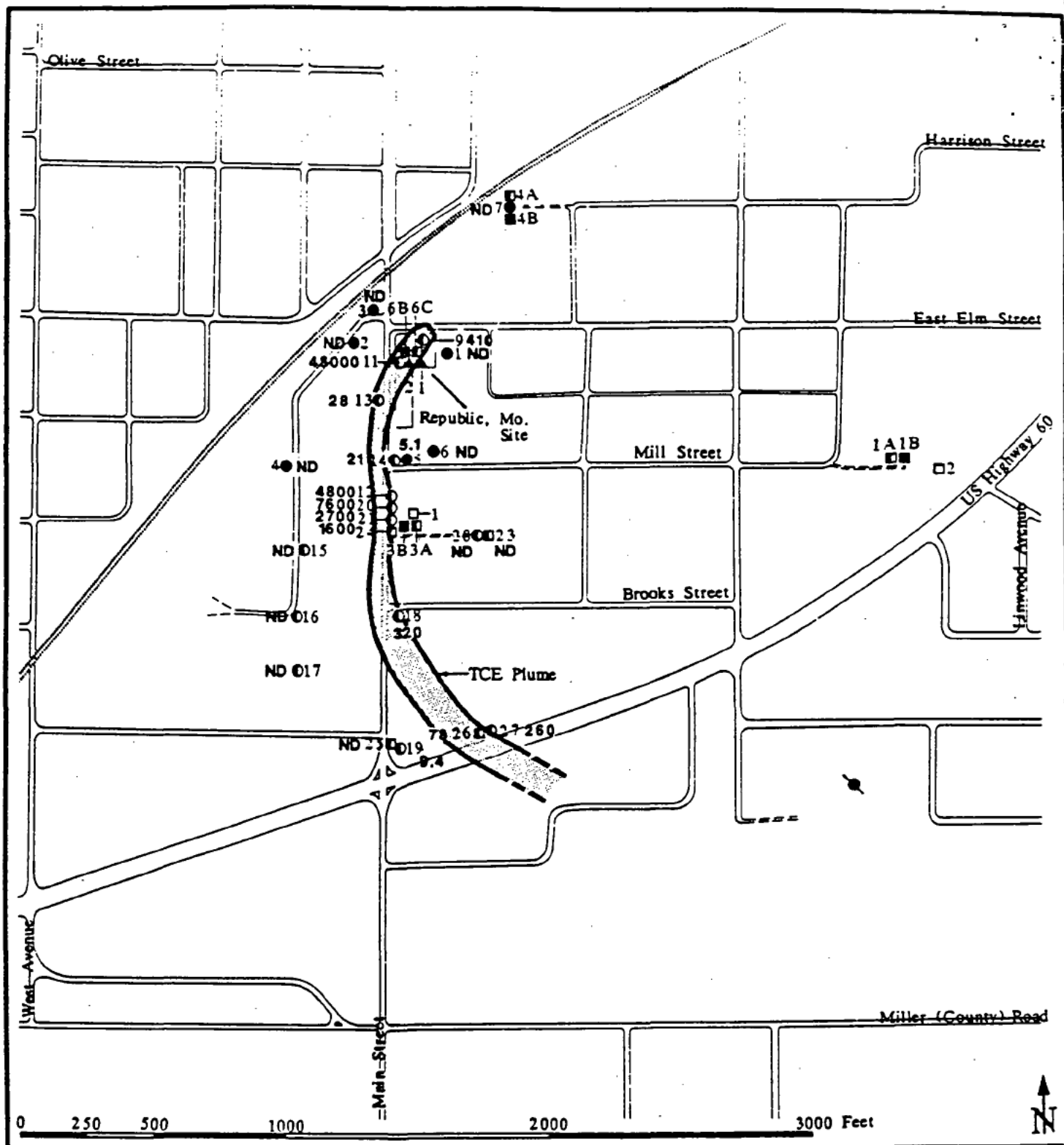
FIGURE 1-1
LOCATIONS OF EXTRACTION
AND MONITORING WELLS

APPROXIMATE SCALE
0' 500'

Prepared by: McLaren/Hart

LEGEND

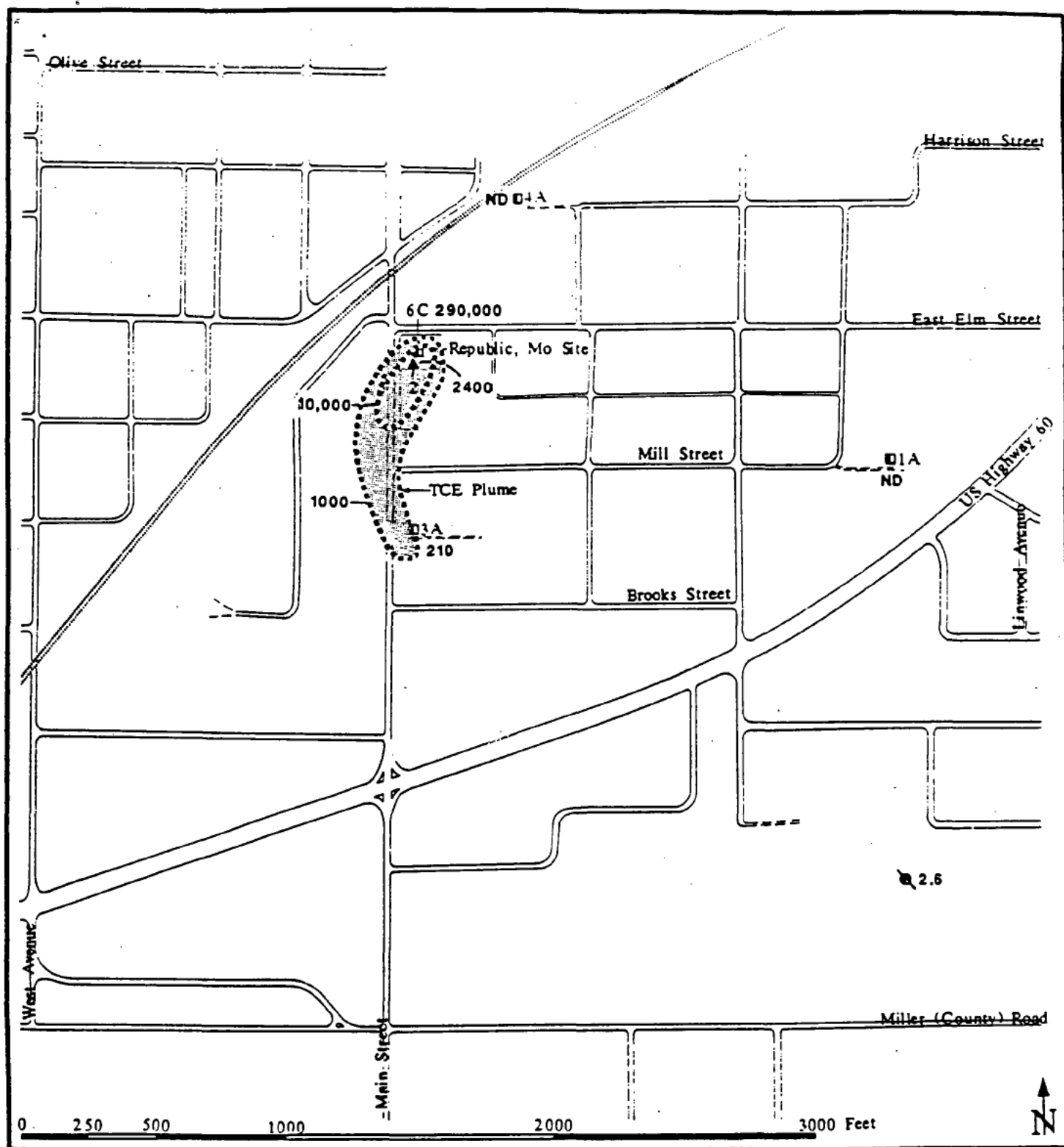
- - Municipal Well [Denoted CW-]
- - DBR Monitoring Well [Denoted SSC-]
- - SBR Monitoring Well [Denoted SSC-]
- - UFSB Monitoring Well [Denoted SSC-]
- - UFSB Monitoring Well [Pre-RI, Denoted MW-]
- ▲ - USEPA Extraction Well [Denoted REM-]
- ★ - UFSB Extraction Well [Denoted SSC-]



GROUND-WATER TCE CONCENTRATIONS, UNCONSOLID./ FRACTURED SHALLOW BEDROCK SYSTEM (UFSB)

- ND Not Detected Above Method Detection Limit The TCE Concentration Shown is the Maximum Reported Value for All Sampling Events
- SSC—Shallow Bedrock Monitoring Well
 - SSC—Deep Bedrock Monitoring Well
 - ▲ REM—Recovery Well
 - CW—Municipal Well
 - SSC—Shallow Unconsolidated Monitoring Well (RI)
 - MW—Shallow Unconsolidated Monitoring Well (Pre-RI)
 - ▼ Cave Well

Figure 6



GROUND-WATER TCE CONCENTRATIONS, UNFRACTURED SHALLOW BEDROCK SYSTEM (SBR)

ND Not Detected Above Method Detection Limit

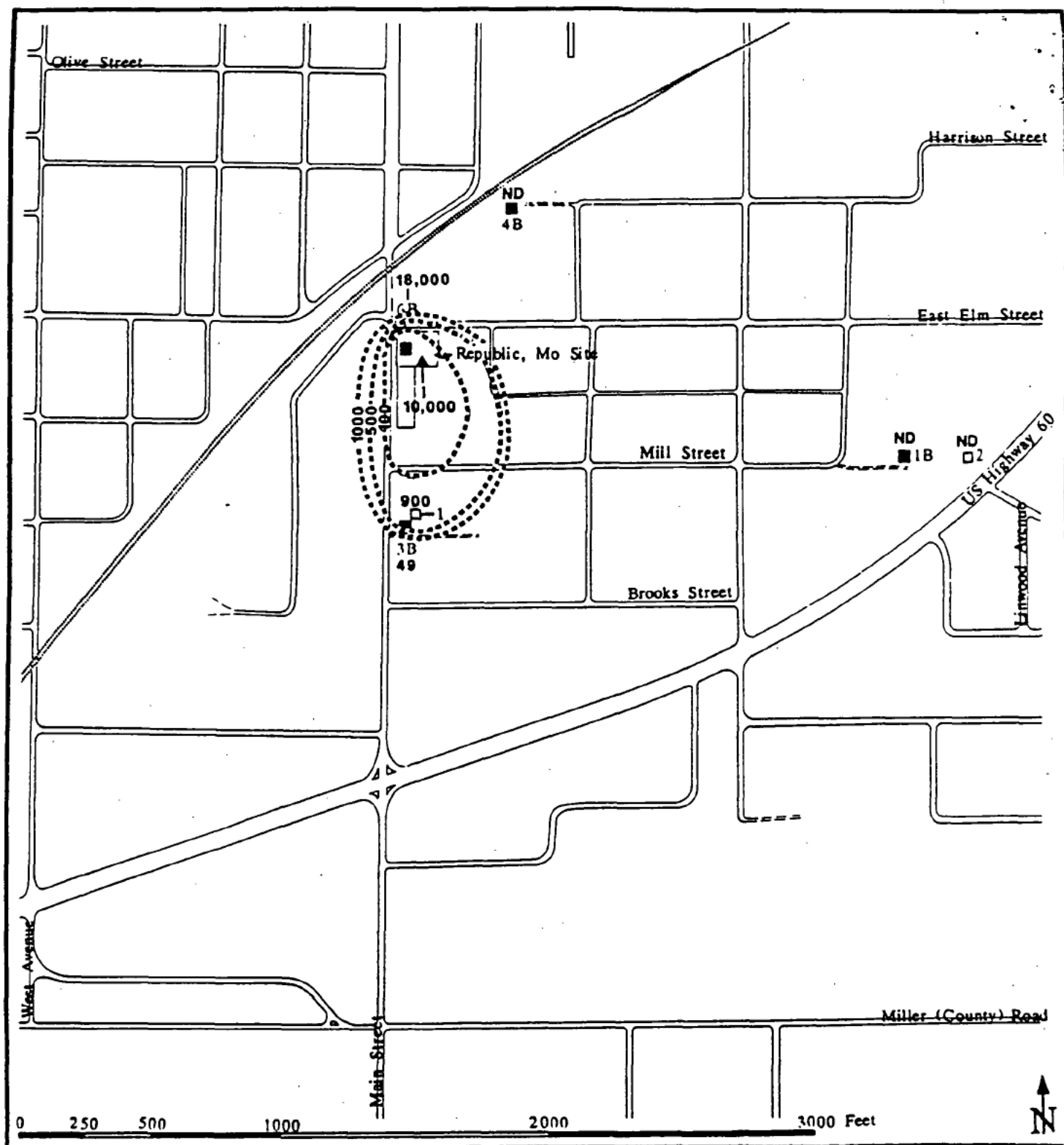
☒ Cave Well

☐ SSC—Shallow Bedrock Monitoring Well

▲ REM—Recovery Well

The TCE Concentration Shown is the Maximum Reported Value
for All Sampling Events
Concentrations in ug/L

Figure 7



GROUND-WATER TCE CONCENTRATIONS, DEEP BEDROCK SYSTEM (DBR)

ND Not Detected Above Method Detection Limit

--- TCE Concentration Contour

□ CW—Municipal Well

▲ REM—Recovery Well

■ SSC—Deep Bedrock Monitoring Well

The TCE Concentration Shown
is the Maximum Reported Value
for All Sampling Events
Concentrations in ug/L

Figure 8

Figure 9 - Relationship between Cave Well, Roberts Spring, and Shuyler Creek

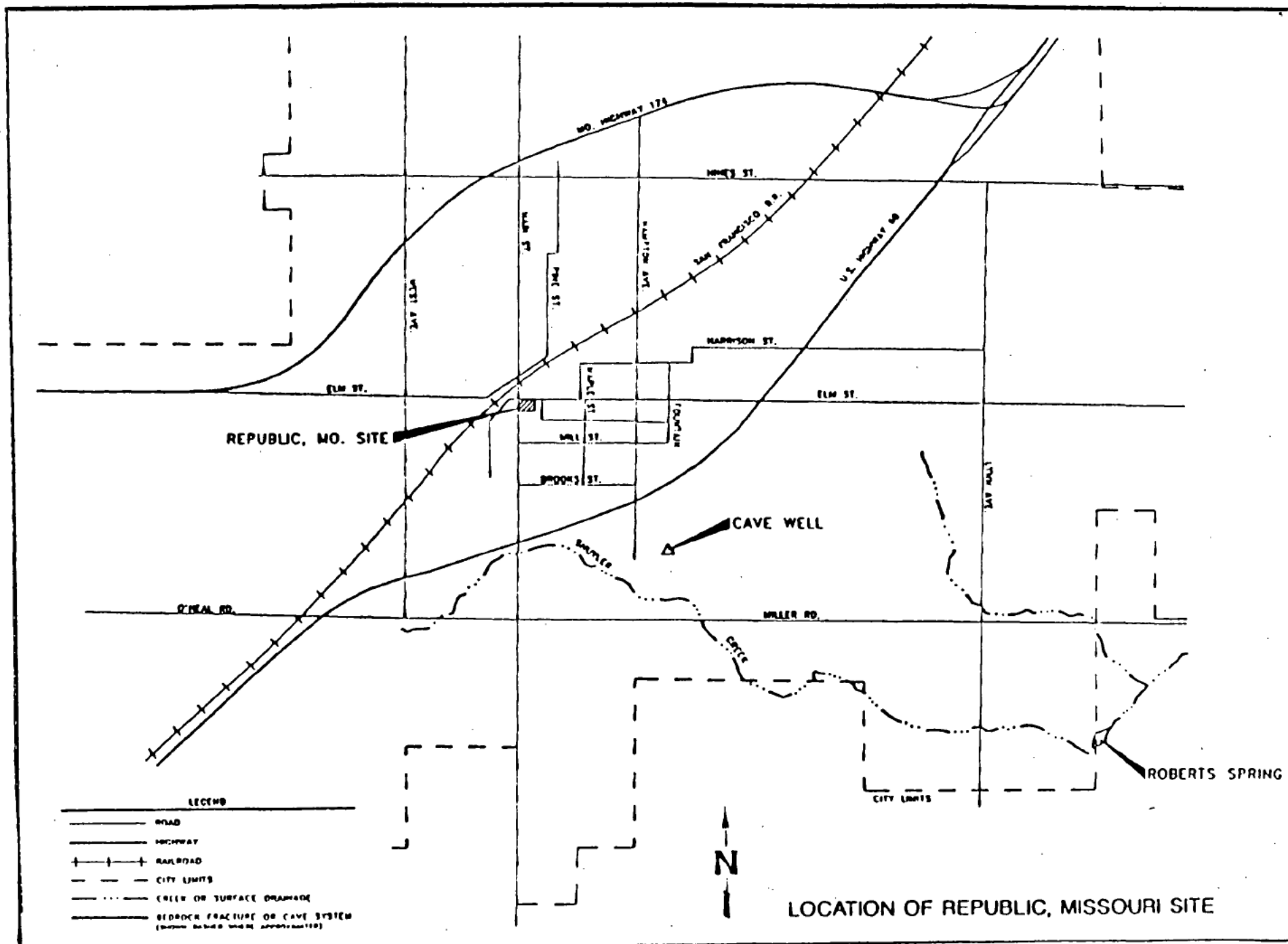
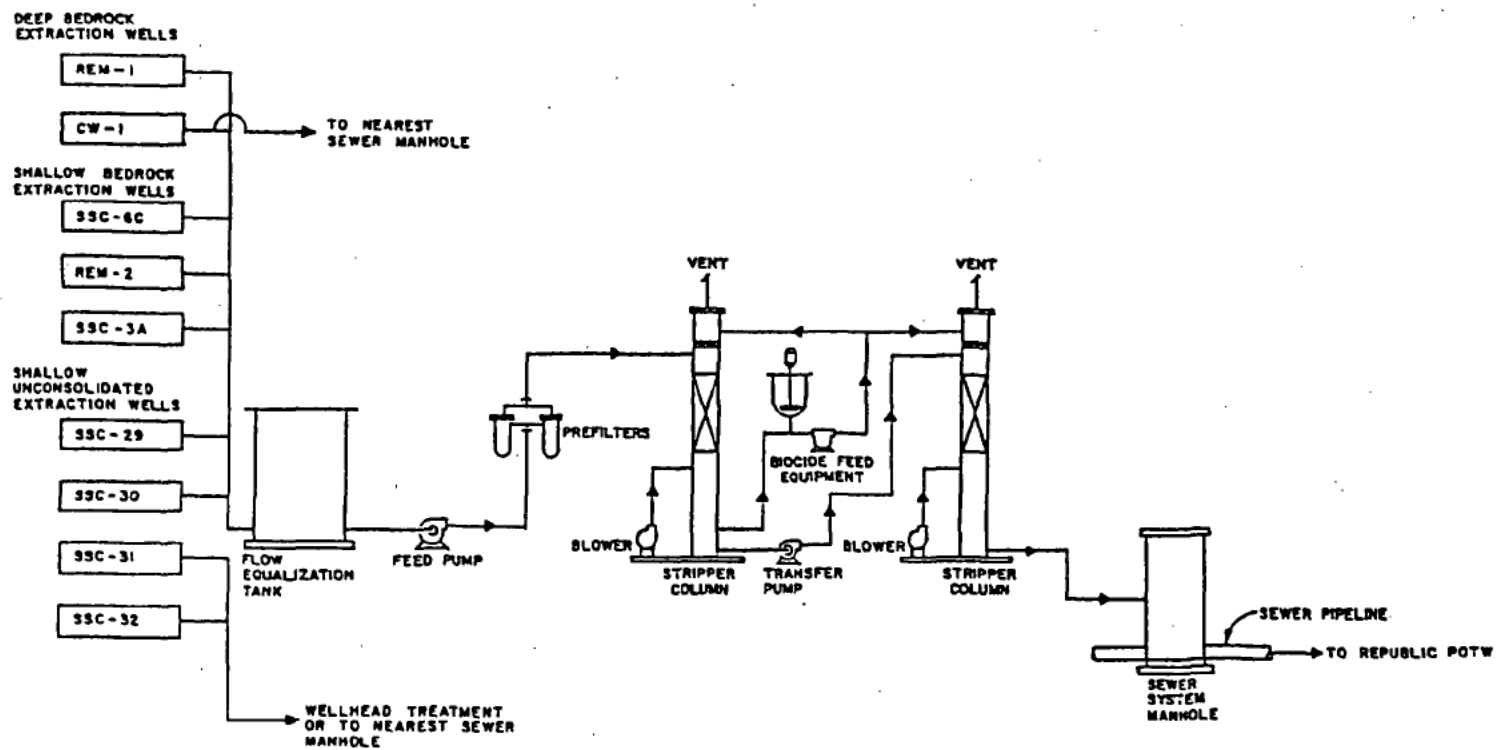


Figure 10
Schematic of Pump and Treat Operation



ALTERNATIVE II
PROCESS FLOW DIAGRAM